

## CLAIMS

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1. A loop-type voltage regulating device, particularly for regulating a voltage of an automotive electric system, including at least one thermal engine, a voltage regulator and an alternator operative to deliver a system-regulated voltage signal to and receive a regulation signal from the voltage regulator, comprising: a control unit within the regulating loop, said unit connected between said thermal engine and said voltage regulator and adapted to supply said voltage regulator with a signal corresponding to the engine operation for regulating the voltage delivered from the alternator.

2. The voltage regulating device of Claim 1, wherein said control unit supplies said voltage regulator with a suitable square-wave phase signal for processing by the voltage regulator.

3. The voltage regulating device of Claim 1, wherein said voltage regulator has at least a first terminal connected to a first terminal of the control unit arranged to deliver said phase signal.

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4. The voltage regulating device of Claim 3, wherein said control unit has at least a second terminal connected to said alternator to receive the system regulated-voltage signal.

5. The voltage regulating device of Claim 1, wherein said control unit is connected to a plurality of sensors providing it with a set of variables related to the engine operation.

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6. The voltage regulating device of Claim 5, wherein the control unit is configured to:

process the incoming variables at a fast rate to generate real time information about the state of engine;

supply, as a phase signal, an accurate assessment of the operational state of the engine in real time; and

predict any later changes of said state.

7. The voltage regulating device of Claim 2, wherein said control unit delivers, on its first terminal, a phase signal in the form of a square-wave signal having similar characteristics as a phase signal from the alternator and being processable by a conventional voltage regulator.

8. The voltage regulating device of Claim 2, wherein said voltage regulator comprises a plurality of buffers and switches effective to regulate the system voltage signal by application of different time constants according to the operational state of the engine and the frequency of the phase signal from the control unit.

9. The voltage regulating device of Claim 8, wherein said voltage regulator is switched off and held in a stand-by condition when no signal is delivered to the control unit.

10. The voltage regulating device of Claim 8, wherein said voltage regulator is switched off and held in a stand-by condition upon the control unit receiving a signal at a frequency below a minimum value.

11. A method of loop regulating a voltage, in particular a voltage of an automotive electric system, comprising:

detecting variables related to the operation of a thermal engine by having a control unit connected to the engine;

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real-time processing the variables detected by the control unit in order to assess the actual conditions of the thermal engine operation;

regulating a system voltage according to the engine conditions of operation using a voltage regulator connected in turn to an alternator of the thermal engine.

12. The method of claim 11, wherein regulating the system voltage comprises generating a phase signal from the control unit that is adapted to be processed by the voltage regulator.

13. The method of claim 12, wherein detecting variables comprises receiving engine performance signals directly from at least one sensor associated with the thermal engine.

14. A voltage system, comprising:  
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- eg.  
a thermal engine configured to receive a regulated voltage and to generate at least one engine performance signal;  
an alternator coupled to the engine and configured to receive a regulation signal and to generate the regulated voltage;  
a voltage regulator coupled to the alternator and configured to receive a phase signal and to generate the regulation signal; and  
a control unit coupled to the thermal engine and to the voltage regulator and configured to receive the at least one engine performance signal and to generate the phase signal in response thereto.

15. The system of claim 14, wherein the control unit is configured to process the at least one engine performance signal in real time.

16. The system of claim 15, wherein the control unit is configured to determine future engine performance from the at least one engine performance signal and to adjust the phase signal in response thereto.

- No vehicle  
- could be "heat engine"

17. The system of claim 14, wherein the control unit is configured to generate the phase signal as a square wave having characteristics similar to characteristics of a phase signal delivered by the alternator before reception by the voltage regulator.

18. The system of claim 14, wherein the control unit has a first terminal configured to deliver the phase signal to a first terminal of the voltage regulator, a second terminal coupled to the alternator to receive the regulated voltage, and at least one additional terminal coupled to the thermal engine to receive the at least one engine performance signal.

19. The system of claim 14, comprising a plurality of sensors, each sensor coupled to the engine and configured to generate an engine performance signal corresponding to a variable related to engine operation.